## Operating Instructions

# SKC Deployable Particulate Sampler (DPS) System

**SKC Inc.**
**863 Valley View Road**
**Eighty Four, PA 15330**

*Form #38044 Rev 1005*

# DPS System Quick Guide

**Media Preparation and Installation**

1. Prepare impaction disks and filters.
2. Disassemble impactor.
3. Insert collection filter in filter cassette.
4. Press prepared impaction disk into top of filter cassette.
5. Reinsert filter cassette in impactor.
6. Reassemble impactor.

**Sampling Setup and Calibration**

1. Set up sample pump. (*See Leland Legacy Quick Guide on page 10. For advanced programming, see Leland Legacy Operating Instructions.*)
2. Screw calibration adapter onto impactor.
3. Use tubing with quick-connect to attach pump inlet to outlet of impactor. Use short tubing to connect inlet of calibration adapter to outlet of mass flow controller or other calibrator to form a calibration train. Calibrate pump flow rate to 10 L/min and record the flow rate.
4. Disconnect mass flow controller (flowmeter) and remove calibration adapter from impactor. Remove calibration media and place new unexposed media in impactor if required.
5. Mount bracket at desired location.
6. Screw impactor onto mounting bracket.
7. Screw rain cover onto impactor.

**Sampling**

1. Turn on pump and record pertinent data. (*Leland Legacy pump may be started manually or automatically, see Quick Guide on page 10.)*
2. Turn off pump after desired sample time has elapsed. Record pertinent information.
3. Remove rain cover, reinstate calibration train, and verify pump flow rate.

**Sample Removal**

1. Use quick-connect to detach tubing from pump.
2. Disassemble impactor.
3. Remove impaction disk.
4. Remove filter cassette, disassemble, and remove collection filter.
5. Place collection filter in appropriate container for shipping.

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# Table of Contents


Introduction ..... 1

Performance Profile ..... 2

Principle of Operation ..... 3

Media Preparation ..... 4

Impactor Preparation ..... 4

- Cleaning ..... 4
- O-ring Care ..... 4
- Inserting a Collection Filter into the IMPACT Sampler ..... 5
- Inserting an Impaction Disk into the IMPACT Sampler ..... 6

Sample Pump Operation ..... 7

- Charging the Battery ..... 7
- Reading the Charging Status LED ..... 8
- Battery Setup ..... 8
- Battery Replacement ..... 9
- Leland Legacy Quick Guide ..... 10

Calibration and Sampling ..... 11

- Calibration ..... 11
- Sampling ..... 12

Sample Removal, Shipping, and Analysis ..... 13

- Removing the Collection Filter and Impaction Disk ..... 13
- Shipping Samples ..... 13
- Analysis ..... 13

Ordering Information ..... 14

Li-Ion Battery Shipment ..... 16

Warranty ..... 17

Indicates a reminder or note

*Indicates a warning or caution*

# INTRODUCTION

The SKC DPS System is a compact, portable, battery-operated, and cost-effective particulate sampling system that ensures the ability to monitor particulate matter (PM) in indoor and outdoor environments and in urban, industrial, or rural settings. The system features the fully programmable constant flow Leland Legacy® Sample Pump, the IMPACT Sampler, and other equipment needed for effective ambient PM10 or PM2.5 sampling. All components are packaged in an easily carried heavy-duty Pelican® case from which the system operates.

The heart of the DPS System is the patented* IMPACT Sampler. This inertial impactor is designed to remove particles larger than a specific cut-point (2.5 µm or 10 µm) by capturing them on a disposable oiled impaction disk that reduces particle bounce. Particles smaller than the cut-point are collected on a 47-mm filter. The IMPACT Sampler mounts easily and makes media changes fast and simple with its convenient removable filter cassette and opener.

** U.S. Patent No. 7,334,453*

*The SKC DPS System includes a Leland Legacy Sample Pump with connection case and charger (100-240 V), IMPACT sampling head, 2 filter cassettes, calibration adapter, rain cover for sampling head, 25 disposable impaction disks, filter cassette opener, tubing with quick-connect fitting, and mounting bracket in a heavy-duty lockable carry case. Two external battery assemblies with adapters are packaged separately. A mass flow controller is available in models 100-3900 and 100-3902 only.*

# PERFORMANCE PROFILE

| | |
|---|---|
| **Flow Rate:** | 10 L/min |
| **50% Cut-point:** | 10 µm or 2.5 µm |
| **Run Time:** | > 24 hours on one battery charge |
| **Power:** | Rechargeable lithium-ion (Li-Ion) battery, 7.4 V, 12-Ah capacity†, 88.8 Wh |
| **Battery Recharge Time:** | 15 hrs |
| **Impaction Disks:** | • ***Recommended impaction disk to reduce particle bounce:*** 37-mm disposable pre-oiled porous plastic disk *(supplied with DPS System)*<br>• ***For chemical analysis of larger particles:*** 37-mm filter (quartz or PTFE§) |
| **Collection Filter:** | 47-mm quartz or PTFE§ with support ring |
| **Analysis:** | Gravimetric and/or chemical |
| **Tubing:** | 3/8-in ID reinforced flexible PVC (supplied) |
| **Temperature:** | Charging: 32 to 113 F (0 to 45 C)<br>Storing: -4 to 95 F (-20 to 35 C)<br>Operating: 32 to 113 F (0 to 45 C) |
| **Operating Humidity:** | 0 to 95% non-condensing |
| **Altitude:** | Do not use pump beyond 7500 ft |
| **RFI/EMI Shielding:** | CE marked |
| **Case Dimensions:** | 18.5 x 14.1 x 6.9 in (47 x 36 x 18 cm) |
| **Complete System Weight:** | 13 lbs (5.9 kg) |
| **Sampling Head (Impactor) Dimensions:** | 2.6 dia. X 1.8 H x 3.8 L in (7 x 5 x 10 cm) |
| **Sampling Head (Impactor) Weight:** | 0.5 lb (0.23 kg) |

***Note:*** *The DPS System provides data similar to data from Federal Reference Method samplers. The DPS System is not a Federal Reference Method sampler.*

† *DPS Systems contain Leland Legacy pumps with Li-Ion batteries and may be subject to special shipping regulations dependent upon quantity.*

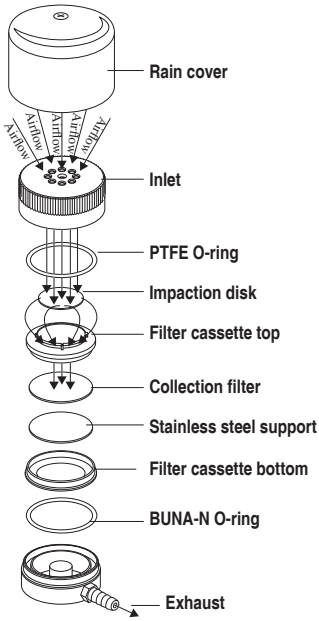
§ *Back pressure on PTFE filters can vary within the same lot.*

# PRINCIPLE OF OPERATION

A sample pump draws particle-laden air at a flow rate of 10 L/min through an inertial impactor to separate airborne particles according to aerodynamic diameter. Particles enter the impactor through eight nozzles on top of the sampler. The inlet nozzles are sized to operate at a 10 L/min flow rate causing eight airjets to impinge onto the impaction disk positioned below the inlet nozzles. Particles larger than the sampler cut-point with enough inertia to cross the airstream lines impact on the impaction disk. The airflow, containing smaller particles, makes a sharp turn, passes through the openings in the top of the filter cassette, and follows through to a 47-mm filter where the smaller particles collect.

The top of the filter cassette accommodates the impaction disk. For optimum impactor performance, a 37-mm oiled porous plastic disk is recommended as disposable collection substrate (supplied with system). If chemical analysis of larger particles is desired, a 37-mm filter (quartz or PTFE) may be used.

*IMPACT Sampler and Leland Legacy Sample Pump - the two main components of the DPS System*




*Exploded view of IMPACT Sampler*

# MEDIA PREPARATION

**Collection Filters:** Equilibrate and pre-weigh filters in a clean environment according to appropriate procedures. Record the weight as the pre-sample weight.

**Impaction Disk:** *Ready-to-use pre-oiled disposable plastic impaction disks are included with the system (qty. 25). Replacement pre-oiled plastic disks are available as SKC Cat. Nos. 225-395 (qty. 25) and 225-395A (qty. 50).* Using an oiled impaction disk reduces particle bounce.

37-mm filters (quartz or PTFE) may be used if chemical analysis of larger particles is desired.

# IMPACTOR PREPARATION

## Cleaning

For optimum performance, the IMPACT Sampler inlet, exhaust, and filter cassette should be cleaned after five runs or upon a noticeable buildup of material. This will remove oil buildup from the top of the filter cassette and other residue built up from frequent sampling. Disassemble the impactor and wash parts in water with a liquid detergent or soap. Rinse and air dry all parts thoroughly in a clean environment.

**Do not place any mechanical object in the inlet nozzles.**

## O-ring Care

Visually inspect the condition of the BUNA-N exhaust O-ring (*see illustration on page 3 for location*). Ensure the O-ring surface is smooth (i.e., without cracks, cuts, or other damage). Ensure the O-ring is fitted properly in its channel. Replace the exhaust O-ring if there is apparent damage, stretching, or thinning. It is recommended that the PTFE inlet O-ring be replaced by the manufacturer only.

## Inserting a Collection Filter into the IMPACT Sampler

The IMPACT Sampler will arrive already assembled. Disassemble it to insert collection filter.

*Unscrew inlet from exhaust.*

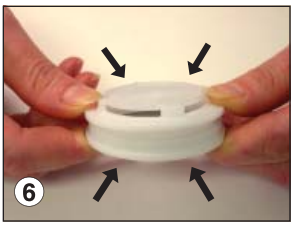
*Remove filter cassette.*

*3a. Use the filter cassette opener to open filter cassette.*

*3b. Slide the filter cassette horizontally into the "U" of the opener until the two halves of the cassette loosen. Gently pull halves apart.*

*Ensure the stainless steel support screen is in place in the bottom of the filter cassette.*

*Using forceps, place a preweighed 47-mm filter on the support screen.*




*Press filter cassette top into filter cassette bottom.*

*Reinsert cassette into impactor.*

***Technical Tidbit***

- Use forceps to carefully insert or remove the collection filter. *See Accessories for forceps.*

## Inserting an Impaction Disk into the IMPACT Sampler

For PM2.5 or PM10 sampling, insert an impaction disk only after a collection filter has been loaded into the filter cassette.

*For PM2.5 or PM10, ensure a collection filter has been loaded into the filter cassette (see Inserting a Collection Filter into the IMPACT Sampler).*

1

*Place impaction disk in recessed area on filter cassette top. The rough side of the impaction disk should face up. SKC-supplied disks are stamped with "UP" on the appropriate side.*

*Place filter cassette on exhaust and screw impactor inlet and exhaust together just until tight. Further hand-tighten by 1/4 turn only.*

**(!) Do not overtighten impactor inlet and exhaust. Do not use barbed fitting as leverage when tightening.**

**(!) Keep sampler upright until the inlet is securely screwed onto the exhaust to prevent the impaction disk from being dislodged.**

### *Technical Tidbits*

- Install the rain cover (included with the DPS System) on the inlet of the IMPACT Sampler when sampling outdoors.
- SKC recommends using a new impaction disk for each sample.

# SAMPLE PUMP OPERATION

The user may choose to operate the pump manually in the field (on/off), program a schedule into the pump manually, or program the pump for multiple schedules from a PC with optional DataTrac® for Leland Legacy Software (*see Ordering Information, Accessories*).

See page 10 for a Quick Guide for operating the SKC Leland Legacy Sample Pump. For advanced programming, see the complete Leland Legacy Pump Operating Instructions.

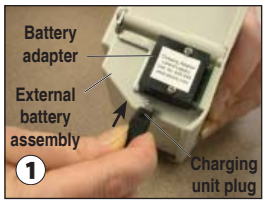
## Charging the Battery

Completely charge a new battery pack using the SKC-approved charger (Cat. No. 223-241) before operating the pump. It may be necessary to charge the battery a few times before maximum battery capacity is achieved.

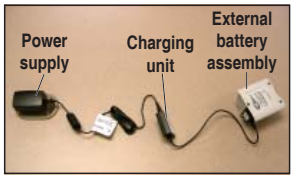
**Cautions:**

- **Do not charge or operate pump with or without charger in hazardous locations.**
- **Use only the SKC-approved charger for this pump. Use of an unapproved charger may damage the battery and pump.**
- **Use of a non-approved charger voids any warranty.**
- **Do not open, disassemble, short circuit, crush, incinerate, or expose the battery to fire or high temperatures.**
- **Tampering with the battery pack voids any warranty.**
- **Ensure proper orientation of charging cable before plugging it into the charging jack. Improper orientation/contact will short-circuit the battery and voids any warranty.**
- **Short-circuiting the battery pack will render it immediately inoperative.**
- **Failure to follow warnings and cautions voids any warranty.**

***The battery pack may be kept on the SKC-approved charger for an indefinite time.***




1. Insert the plug from the charging unit into the charging port on the battery adapter (on top of the external battery assembly).
2. Insert plug from power supply into the jack on the charging unit.
3. Install the appropriate wall plug on the power supply and plug power supply into a power outlet.



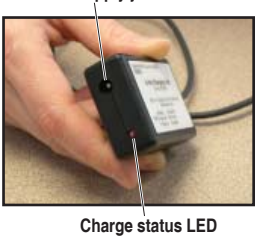

The battery will recharge in approximately 15 hours. For a complete charge, do not run the pump connected to the external battery assembly

during charging. After charging is complete, disconnect battery from charger and connect pump to battery (*see Battery Setup*).

***After charging the battery pack, it is good practice to run the pump for approximately 5 minutes before calibrating. This ensures the battery is in more steady-state conditions and improves the agreement in pre and post-sampling calibrations.***

## Reading the Charging Status LED

The Li-Ion Charging Unit indicates battery charge status via an LED on the unit that blinks in specific patterns. Observe the LED steadily for > 5 seconds to read charge status.




| LED Action | | | | Charge Status |
|---|---|---|---|---|
| ON ✷ steady | | | | Charge in progress |
| ON ✷ 2 sec | OFF ○ .25 sec | ON ✷ 2 sec | (Repeats) | Approximately 80% charged |
| OFF ○ 2 sec | ON ✷ .25 sec | OFF ○ 2 sec | (Repeats) | Charge completed |

***For more information on SKC pump batteries, go to http://www.skcinc.com/instructions/1756.pdf.***

## Battery Setup

1. Insert the plug on connecting cable from pump into the jack on the battery adapter (on top of the external battery assembly).

2. Insert external battery assembly into a foam compartment in the case. Ensure there is no tension on the connecting cable.

## Battery Replacement

1. **Record all necessary data before unplugging pump from battery.**

2. Remove plug on connecting cable from jack on battery adapter (on top of the external battery assembly).

3. Insert plug on connecting cable into battery adapter jack on new, fully charged external battery assembly.

4. Insert external battery assembly into foam compartment in case. Ensure there is no tension on the connecting cable.

# Leland Legacy Quick Guide

## Terms »

**Star button ✷**
• Scrolls through run time data and Setup options

**Up and down arrow buttons ▲▼**
• Toggle between display choices and increase or decrease sampling parameters in Setup

**Button sequence**
▼ ✷= press buttons individually
[▲▼] = press simultaneously
✷▲▼✷ = security code, always press in sequence

**Security code ✷▲▼✷**
• Prevents unauthorized changes to the pump's sampling program

## Programming Sequences »

**• To activate pump (e.g., to change pump from Sleep to Hold):**
Press any button.

**• To change pump from Hold to Run or Run to Hold:**
Press [▲▼].

**• To reset accumulated data:**
Press [▲▼] then ✷▲▼✷. Press ✷ until *CLr* displays then press [▲▼]; press ✷ until *End* displays then press [▲▼].

**• To set pump flow rate:**
Press [▲▼], then ✷▲▼✷. Flow rate and SET flash. Press ▲ or ▼ to change flow rate. Press ✷ until *End* appears then press [▲▼] to save setting and place pump in Hold.

**• To calibrate flow rate with standard calibrator:**
Press [▲▼], then ✷▲▼✷. Flow rate and SET flash. Press ▲ or ▼ to change flow rate. Press ✷ once. *ADJ* displays. Press ▲ or ▼ until desired flow rate is indicated on calibrator. When finished, press ✷ until *End* displays then press [▲▼] to save new setting and place pump in *Hold. For CalChek Calibration, see operating instructions.*

**• To change temperature scale from F to C or C to F:**
Press [▲▼], then ✷▲▼✷. Press ✷ until temperature displays. Press ▲ or ▼ to switch units; press ✷ until *End* displays then press [▲▼] to save new setting.

**• To change atmospheric pressure scale (mm, mb, In):**
Press [▲▼], then ✷▲▼✷. Press ✷ until pressure displays then press ▲ or ▼ to switch units; press ✷ until *End* displays then press [▲▼] to save new setting.

**• To change time scale (12 Hr/24 Hr/Dela):**
Press [▲▼], then ✷▲▼✷. Press ✷ until 12 Hr, 24 Hr, or Dela displays then press ▲ or ▼ to switch units; press ✷ until *End* displays then press [▲▼] to save new setting. *To set delayed start (Dela), see operating instructions.*

**• To change clock:**
Press [▲▼], then ✷▲▼✷. Press ✷ until clock displays then press ▲ or ▼ to change flashing hour; press ✷ to move to minutes and ▲ or ▼ to change setting. Press ✷ until *End* displays then press [▲▼] to save new setting.

**• To change the sampling time function:**
Press [▲▼], then ✷▲▼✷. Press ✷ until *ST L/min* displays then press ▲ to change flashing digit; press ✷ until *End* displays then press [▲▼] to save new setting. To delete, follow above steps and press ▼ until 0 appears. Exit Setup.

**Note: When in Setup, choosing Esc instead of End will exit Setup without saving new settings.**

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# CALIBRATION AND SAMPLING

## Calibration

Calibrate pump flow rate with the IMPACT Sampler in line (loaded with filter and impaction disk). ***See pump and calibrator operating instructions.***

*Ensure the pump has run for 5 minutes before proceeding with calibration. Ensure rain cover is removed from inlet and that impactor is loaded and fully assembled (see Inserting a Collection Filter into the IMPACT Sampler and Inserting an Impaction Disk into the IMPACT Sampler).*

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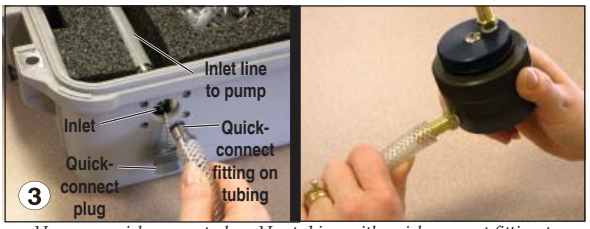
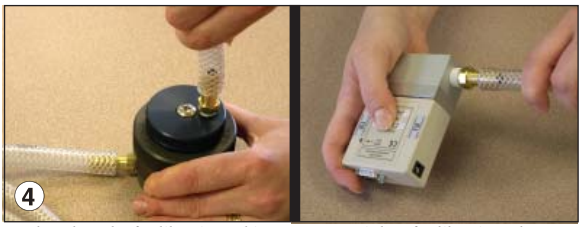
*Screw calibration adapter onto impactor inlet.*

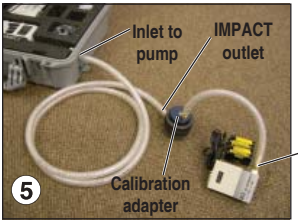



*Unscrew quick-connect plug. Use tubing with quick-connect fitting to attach case (pump) inlet to outlet of impactor.*

**Ensure O-ring is installed on the quick-connect fitting before inserting it into the inlet. Absence of the O-ring can affect measurements.**




*Use short length of calibration tubing to connect inlet of calibration adapter to outlet of a mass flow controller or other calibrator to form a calibration train.*




**Mass flow controller or calibrator outlet**

*Set pump flow rate to 10 L/min (see Leland Legacy Quick Guide on page 10) and check the flow of the sampler. Record the flow rate. See pump and calibrator operating instructions.*

*When calibration is completed, disconnect calibrator and tubing from calibration adapter. Remove calibration adapter from impactor.*

6

## Sampling

1. If required, replace representative sample media used for calibration with new, pre-weighed media (*see Media Preparation and Impactor Preparation*).

2. Mount bracket at the desired location and at breathing zone height (6 feet or 2 meters) using wire ties or other fasteners. Mount impactor on mounting bracket by threading clamp knob into bottom of impactor.

3. Insert screw on rain cover into screw hole in top of impactor inlet and rotate cover until tight.

4. Turn on pump and record sample start time, ambient temperature, ambient pressure, and other pertinent data.

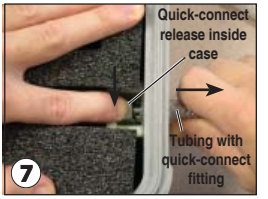
***Sample start time and duration can be programmed into the Leland Legacy Sample Pump in advance and sampling may be started manually or automatically.***

**Record all necessary data before disconnecting pump from battery and reconnecting to new battery.**

5. After desired sample time has elapsed, turn off pump and record sample stop time, total volume, ambient temperature, ambient pressure, and other pertinent data.

6. Remove rain cover, reinstate calibration train, and verify flow rate (*see Calibration*).

7. Reach inside case and press quick-connect release while pulling tubing from inlet. Remove tubing from impactor.




***Technical Tidbits***

- The supplied rain cover should be used for all outdoor sampling.
- Keep Leland Legacy sample pump inside the Pelican case and the case closed during sampling to protect sample pump from weather.

# SAMPLE REMOVAL, SHIPPING, AND ANALYSIS

## Removing the Collection Filter and Impaction Disk

*Unscrew impactor inlet from exhaust.*

*Locate recessed area on filter cassette top and remove impaction disk. If chemical analysis of larger particles is desired, place in appropriate container for shipping to a laboratory for analysis (see Ordering Information, Accessories for glass jars).*

*Gently lift filter cassette from exhaust.*

*4a. Use the filter cassette opener to separate the two halves.*

*4b. Slide the filter cassette horizontally into the "U" of the opener until the two halves of the cassette loosen. Gently pull halves apart.*

*Use forceps to remove collection filter and place in appropriate container for shipping to a laboratory.*

## Shipping Samples

Package and transport samples and blanks in a manner that will prevent sample loss and contamination. *See Ordering Information, Accessories for the petri dish slide for transporting samples.*

## Analysis

Gravimetric and/or chemical by an accredited laboratory

# ORDERING INFORMATION

| Description | | Cat. No. |
|---|---|---|
| **DPS System*†#** includes sample pump with connection case and charger (100-240 V), IMPACT sampling head, 2 filter cassettes, calibration adapter, rain cover for sampling head, 25 disposable impaction disks$^{\Delta}$, filter cassette opener, tubing with quick-connect fitting, and mounting bracket in a heavy-duty lockable carry case. Two external battery assemblies with adapters are packaged separately. | | |
| | PM10 Kit | **100-3901#** |
| | PM10 Kit with mass flow controller | **100-3900#** |
| | PM2.5 Kit | **100-3903#** |
| | PM2.5 Kit with mass flow controller | **100-3902#** |

* *Provides data similar to data from Federal Reference Method samplers. The DPS System is not a Federal Reference Method sampler.*

† *Quantity discounts available*

\# *DPS Systems contain Leland Legacy pumps with Li-Ion batteries and may be subject to special shipping regulations dependent upon quantity.*

$\Delta$ *Limited shelf-life*

| **Collection Filters for System**<br>*Select a collection filter based on your application.* | |
|---|---|
| **Quartz,** 47 mm, Tissuquartz™, 432 µm thick, pk/25 | **225-1823** |
| **PTFE Filters§‡,** 47 mm, 2.0 µm, PMP support ring, pk/50 | **225-1747§‡** |

| **Impaction Disks for System**<br>*Select an impaction disk based on your application.* | | |
|---|---|---|
| **Recommended to Reduce Particle Bounce:** | | |
| **Replacement Pre-oiled Impaction Disks** | pk/25 | **225-395** |
| porous plastic disks, 37 mm, pre-oiled, *limited shelf-life* | pk/50 | **225-395A** |
| **For Chemical Analysis of Larger Particles:** | | |
| **Quartz Filters,** 37 mm, Tissuquartz™, 432 µm thick, pk/25 | | **225-1822** |
| **PTFE Filters§,** 37 mm, 2.0 µm, laminated PTFE support, pk/50 | | **225-27-07§** |

§ *Back pressure on PTFE filters can vary within the same lot.*

‡ *Maximum operating temperature is 464 F (240 C) based on PMP support ring.*

| **Accessories** | | |
|---|---|---|
| **Forceps,** stainless steel | | **225-8371** |
| **Petri Dish Slide,** for filter transport, pk/100 | | **225-2-01** |
| **Glass Jars for Chemical Analysis** | pk/8 | **225-8376** |
| | pk/36 | **225-8377** |
| **DataTrac for Leland Legacy Software** includes software on CD, DataTrac adapter, and DataTrac cable, *requires Windows 98 or higher and available serial port or USB to serial adapter compatible with the PC and system* | | **877-92** |

# ORDERING INFORMATION

| Replacement Parts | | Cat. No. |
|---|---|---|
| **IMPACT Sampler Inlets** | PM10 | **P54202** |
| | PM2.5 | **P54204** |
| **IMPACT Sampler Inlet O-rings,** pk/3 | | **P31989** |
| **IMPACT Sampler Exhaust** | | **P21279** |
| **IMPACT Sampler Exhaust O-ring** | | **P31988** |
| **Quick-connect O-rings,** pk/3 | | **P31996** |
| **Filter Cassette** | | **225-396** |
| **Cassette Opener** | | **225-397** |
| **Rain Cover,** grey | | **225-398** |
| **Mounting Bracket** | | **225-399** |
| **Quick-connect Fitting,** on 6.5-foot reinforced PVC tubing | | **P42741** |
| **Reinforced Flexible PVC Tubing,** 6.5 feet | | **P30004** |
| **Silicone Tubing,** 0.4 feet, pk/2 | | **P30255A** |
| **Calibration Adapter** | | **225-394** |
| **Mass Flow Controller** | | **P16110** |
| **DPS Operating Instructions** | | **P40101** |
| **DPS Quick Guide** | | **P37139** |
| **Leland Legacy Pump Operating Instructions** | | **P40075** |
| **Leland Legacy Pump Quick Guide** | | **P37138** |
| **Calibration Tubing,** 1 foot, reinforced flexible PVC tubing | | **P300041** |
| **Quick-connect Plug** with retaining chain | | **P42742** |
| **External Battery Assembly** with battery adapter | | **223-247** |
| **Battery Connection Case** with cable and plug | | **223-249** |
| **DPS/DVS Charger Adapter** | | **223-245** |
| **DPS/DVS Charging Unit** | | **P22300** |

# LI-ION BATTERY SHIPMENT

Rechargeable, lithium-Ion batteries for use with SKC sampling pumps have been tested in accordance with the UN Manual of Tests and Criteria and are designated as UN3091. They have a watt-hour (Wh) rating below 100.

***For air shipments:***
**Per 2009 IATA regulations,** packaging must meet the specifications of and contain labeling and documentation required by IATA Packing Instructions 965, 966, and 967. Per these instructions:

- Boxes containing Li-Ion batteries only cannot exceed a maximum gross weight of 22 pounds (10 kg).
- The maximum number of batteries packed with equipment is the number required to power equipment in the box plus 2 spare batteries per unit.
- There is no maximum limitation for batteries contained within equipment.

***For ground shipments:***
U.S. DOT regulations specify a limit of 24 or fewer battery cells in one shipping box. To be exempt from Dangerous Goods Shipping requirements, the box must contain 24 or fewer cells. Therefore, limit any box to be shipped via ground to the following number of pumps:

- Leland Legacy Pump - 2 pumps

***Contact SKC for more information or refer to the regulatory authority in your area.***

# SKC Limited Warranty and Return Policy

SKC products are subject to the SKC Limited Warranty and Return Policy, which provides SKC's sole liability and the buyer's exclusive remedy. To view the complete SKC Limited Warranty and Return Policy, go to http://www.skcinc.com/warranty.asp.